UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/517,367	08/26/2005	Donald T. Miller	000687.00355	3974

27557 7590 07/11/2007
BLANK ROME LLP
600 NEW HAMPSHIRE AVENUE, N.W.
WASHINGTON, DC 20037

EXAMINER	
ROBERTS, MICHAEL P	

ART UNIT	PAPER NUMBER
2873	

MAIL DATE	DELIVERY MODE
07/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/517,367	MILLER ET AL.	
	Examiner	Art Unit	
	Michael P. Roberts	2873	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-56* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *52-54* is/are allowed.

6)☒ Claim(s) *1-10,16-35,37,38,42,43,45-48 and 55* is/are rejected.

7)☒ Claim(s) *11-15,36,39-41,44,49-51 and 56* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20041210*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. **Claim 11** is objected to because of the following informalities: line 1 contains the text, "RU-ther". For purposes of examination the examiner interprets the claim as if "Ru-ther" was not present. Appropriate correction is required.

2. **Claim 12** is objected to because of the following informalities: line 1 contains the text, "fin-ther". For purposes of examination the examiner interprets the claim as if "fin-ther" was intended to read, "further". Appropriate correction is required.

3. **Claim 40** is objected to because of the following informalities: step (v) contains text with several words and/or groups of letters jumbled together. For purposes of examination the examiner interprets the claim as if step (v) recited, "...create a 1D-OCT sample light beam and a 1D-OCT reference light beam, each having an optical path length..." Appropriate correction is required.

4. **Claim 41** is objected to because of the following informalities: line 6 contains the text, "0) a 113-OCT detector", which is inconsistent with the lettering of the claim, and is inconsistent with the rest of the disclosure. For purposes of examination the examiner interprets the claim as if "0) a 113-OCT detector" was intended to read, "(j) a 1D-OCT detector". Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. **Claims 1-5, 8-10, 19-20, 22-28, 34, and 42-43** are rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521).

Regarding **claim 1**, Swanson '147 discloses a method of optical imaging (title; abstract) comprising: providing a sample (object 28) to be imaged (Fig. 2; col. 5, line 57-col. 6, line 58); and imaging the sample by optical coherence tomography (Fig. 2; col. 5, line 57-col. 6, line 58), but does not specifically disclose the step of measuring and correcting aberrations associated with the sample by using adaptive optics. In the same field of endeavor of methods of optical imaging, Williams '521 teaches of a method of optical imaging comprising the step of measuring and correcting aberrations associated with a sample using adaptive optics (Fig. 1; col. 4, line 13-col 5, line 40) for the purpose of improving visual performance and providing high resolution retinal images of the eye (col. 4, line 13-col. 5, line 40). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 to include the step of measuring and correcting aberrations associated with the sample using adaptive optics since Williams '521 teaches of a method of optical imaging comprising the step of measuring and correcting aberrations associated with a sample using adaptive optics for the purpose of improving visual performance and providing high resolution retinal images of the eye.

Regarding **claim 2**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Williams '521 further teaches that the aberrations associated with the sample are measured and corrected by (i) illuminating the sample with a point source light beam having a wavefront (Fig. 1; col. 4, lines 22-37), (ii) detecting the wavefront of the point source light beam that is reflected from the sample with a wavefront sensor (148) to measure wavefront distortions of the sample (Fig. 1; col. 4, line 38-col. 5, line 41), and (iii) adjusting a wavefront corrector (deformable mirror 118) so as to compensate for the

wavefront distortions that are associated with the sample (Fig. 1; col. 4, lines 13-21; col. 5, lines 12-41).

Regarding **claim 3**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Williams '521 further teaches that steps (i)-(iii) are repeated in a closed loop until the wavefront corrector (118) imparts a shape onto the wavefront that is identical, but opposite in sign (conjugate), to the measured wavefront distortion (col. 4, lines 13021; col. 5, lines 11-41).

Regarding **claims 4 and 8**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Swanson '147 further teaches that the sample is imaged by (iv) generating a beam of low temporal coherence two-dimensional OCT light from a light source (Fig. 2; col. 5, lines 57-63, wherein the light beam travels in two dimensions), (v) splitting the beam of low temporal coherence light to create a sample light beam (image radiation 17b) and a reference light beam (reference radiation 17a), each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged (Figs. 2-3; col. 6, line 2-col. 7, line 2), (vi) illuminating the sample (object 28) with the sample light beam (17b) (Figs. 2-3; col. 6, lines 2-24), (vii) illuminating a reference mirror (reference scatterer 32) with the reference light beam (17a) (Figs. 2-3; col. 6, lines 2-24), (viii) superimposing the reflected sampled light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position (Figs. 2-3; col. 6, lines 2-41), (ix) recording the interference patter using a detector (54) (col. 6, lines 34-58), (x) generating a two-dimensional image of the sample from the interference pattern (col. 6, lines 54-58; col. 11, lines 23-37).

Regarding **claims 5 and 9**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Swanson '147 further teaches the steps of (xi) changing the optical path length to generate a series of coherence gate positions within the sample (Figs. 2-3; col. 7, lines 29-40; col. 10, line 35-22), (xii) recording a series of interference patterns and generating a series of corresponding two-dimensional image patterns from the interference patterns (col. 11, lines 23-37; col. 6, lines 2-58), and (xiii) constructing a three dimensional image of the sample from the two-dimensional images (col. 2, lines 20-37; col.1 3, lines 14-16).

Regarding **claim 10**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Williams '521 further teaches that steps (i)-(iii) are completed prior to step (ix) (col. 7, lines 14-16, wherein the step of measuring and correcting aberrations using adaptive optics is completed before images of the sample are recorded with the detector).

Regarding **claim 19**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Williams '521 further teaches that the sample is an eye (Fig. 1; col. 4, lines 13-36).

Regarding **claim 20**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Williams '521 further teaches that the sample is retinal or fundus tissue (col. 7, lines 14-16, 39-61).

Regarding **claim 22**, Swanson '147 discloses an optical imaging apparatus (title; abstract) comprising a two-dimensional optical coherence tomography (OCT) system (Fig. 2; col. 5, line 57-col. 6, line 58, wherein the light beam travels in two dimensions), but does not specifically

disclose an adaptive optics (AO) subsystem. In the same field of endeavor of optical imaging, Williams '521 teaches of an adaptive optics subsystem (Fig. 1; col. 4, line 13-col 5, line 40) for the purpose of improving visual performance and providing high resolution retinal images of the eye (col. 4, line 13-col. 5, line 40). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the optical imaging apparatus of Swanson '147 to include an adaptive optics subsystem since Williams '521 teaches of an optical imaging subsystem including an adaptive optics subsystem for the purpose of improving visual performance and providing high resolution retinal images of the eye.

Regarding **claim 23**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Williams '521 further teaches that the AO subsystem comprises (a) a point light source for adaptive optics (col. 4, lines 13-37), (b) a wavefront sensor (148) (col. 4, lines 38-48), and (c) a wavefront corrector (118) (col. 4, lines 38-48).

Regarding **claim 24**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Swanson '147 further teaches that the point light source (12) is selected from the group consisting of a laser diode and a light emitting diode (col. 8, lines 7-19).

Regarding **claim 25**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Williams '521 further teaches that the wavefront sensor is a Shack-Hartmann wavefront sensor (col. 4, lines 13-48).

Regarding **claim 26**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Williams '521 further teaches that the wavefront corrector (118) is selected from the group consisting of a deformable mirror, a bimorph mirror, a

liquid crystal spatial light modulator, and a micro-opto-electro-mechanical system (col. 5, lines 24-26).

Regarding **claim 27**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Williams '521 further teaches that the wavefront corrector (118) is a liquid crystal spatial light modulator or a micro-opto-electro-mechanical system (col. 5, lines 24-26).

Regarding **claim 28**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Swanson '147 further teaches that the 2D-OCT subsystem comprises (d) a 2D-OCT low temporal coherence light source (col. 5, lines 57-63), (e) a beam splitter (22) (Fig. 2; col. 6, lines 2-5), (f) a reference mirror (reference scatterer 32) (Fig. 2; col. 6, lines 5-9), (g) a means of modulating an optical path length of a reference beam (Fig. 2; col. 7, lines 29-40; col. 10, line 35-col. 11, line 22), and (h) a 2D-OCT detector (CCD 54) (Fig. 2; col. 6, lines 34-58).

Regarding **claim 34**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, and Swanson '147 further teaches that the 2D-OCT detector is a CCD detector (Fig. 2; col. 6, lines 34-58).

Regarding **claim 42**, Williams '521 discloses a method for optically imaging a sample of retinal or fundus tissue in an eye (col. 7, lines 14-61), the method comprising: (a) providing an optical imaging system comprising an adaptive optical element (118) (Fig. 1; col. 4, line 13-col. 5, line 41); (b) measuring wavefront aberrations in the eye (col. 4, line 13-col. 5, line 41); (c) controlling the adaptive optical element (118) to correct the wavefront aberrations measured in step (b) (col. 5, lines 12-41); (e) adjusting the optical imaging system to compensate for a

determined distance (col. 5, lines 12-41, wherein the mirror 118 is adjusted to compensate for the measured aberrations), but does not specifically disclose the steps of (d) performing a first optical coherence tomography operation on the sample to determine a distance from the sample to the optical imaging system, and (f) performing a second optical coherence tomography operation on the sample to image the sample. In the same field of endeavor of methods for optically imaging a sample of retinal or fundus tissue in an eye, Swanson '147 teaches of performing a first optical coherence tomography operation on a sample and determining a distance from the sample to the optical imaging system (Figs. 2-3; col. 5, line 57-col. 7, line 61, wherein a first OCT operation is performed on a sample, and a distance from the sample to the imaging system is defined as d3), and performing a second optical coherence tomography operation on the sample to image the sample (col. 5, line 57-col. 6, line 58; col. 7, lines 29-40; col. 10, line 35-col. 11, line 22, wherein a second OCT operation is performed on the sample after moving scatterer 32 to image the sample), for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object (col. 3, lines 35-41). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Williams '521 to include the steps of (d) performing a first optical coherence tomography operation on the sample to determine a distance from the sample to the optical imaging system, and (f) performing a second optical coherence tomography operation on the sample to image the sample, since Swanson '147 teaches of performing a first optical coherence tomography operation on a sample and determining a distance from the sample to the optical imaging system, and performing a second optical coherence tomography operation

on the sample to image the sample, for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object.

Regarding **claim 43**, Williams '521 and Swanson '147 disclose and teach of method as shown above, and Swanson '147 further teaches that the second optical coherence tomography operation is a two-dimensional OCT operation (col. 5, line 57-col. 6, line 58; col. 7, lines 29-40; col. 10, line 35-col. 11, line 22, wherein the second OCT operation uses a beam that travels in two dimensions).

9. **Claims 6 and 30** are rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521), as applied to independent **claims 1 and 22** above, and further in view of Bille '430 (US 4,579,430).

Regarding **claim 6**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, but do not specifically disclose or teach that the sample is illuminated by a scanning point light source. In the same field of endeavor of methods of optical imaging, Bille '430 teaches of illuminating a sample with a scanning point light source for the purpose of reducing strain on the patient during the generation of an ocular image (abstract). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 and Williams '521 to include that the sample is illuminated by a scanning point light source since Bille '430 teaches of illuminating a sample with a scanning point light source for the purpose of reducing strain on the patient during the generation of an ocular image.

Regarding **claim 30**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, but do not specifically disclose or teach that the low temporal coherence light source is a scanning point source. In the same field of endeavor of optical imaging, Bille '430 teaches of illuminating a sample with a scanning point light source for the purpose of reducing strain on the patient during the generation of an ocular image (abstract). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the apparatus of Swanson '147 and Williams '521 to include that the low temporal coherence light source is a scanning point light source since Bille '430 teaches of illuminating a sample with a scanning point light source for the purpose of reducing strain on the patient during the generation of an ocular image.

10. **Claims 7, 16-18, 29, 37, 38, 45-47** are rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521), as applied to independent **claims 1, 22, and 42** above, and further in view of Davenport '242 (US 6,663,242).

Regarding **claim 7**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, but do not specifically disclose or teach that the sample is illuminated by a flood illumination light source. In the same field of endeavor of optical imaging, Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made

for the method of Swanson '147 and Williams '521 to include that the sample is illuminated by a flood illumination light source since Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

Regarding **claim 16**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, and Swanson '147 further discloses illuminating the sample with a low coherent illumination light source to focus on a region of the sample (col. 5, line 57-col. 6, line 23), detecting the low coherent illumination light that is reflected from the sample with a low coherent illumination light detector (54) (col. 6, lines 34-58), and optionally adjusting the focus within the sample to image at a plurality of depths in the sample (col. 7, lines 28-40; col. 10, lines 35-55, wherein scatterer 32 is moved to image the sample at a plurality of depths), but does not specifically disclose that the sample is illuminated by a flood illumination light source. In the same field of endeavor of optical imaging, Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 and Williams '521 to include that the sample is illuminated by a flood illumination light source since Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

Regarding **claim 17**, Swanson '147, Williams '521, and Davenport '242 disclose and teach of a method of optical imaging as shown above, and Swanson '147 further discloses that the low coherent illumination light source has low spatial coherence (col. 5, lines 57-63).

Regarding **claim 18**, Swanson '147, Williams '521, and Davenport '242 disclose and teach of a method of optical imaging as shown above, and Swanson '147 further discloses that the low coherent illumination light detector (54) is the same as the 2D-OCT detector (col. 6, lines 2-58; Fig. 2).

Regarding **claims 29 and 37**, Swanson '147 and Williams '521 disclose and teach of an optical imaging apparatus as shown above, but do not specifically disclose or teach that the low temporal coherence light source is a flood illumination source. In the same field of endeavor of optical imaging, Davenport '242 teaches of illuminating a sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the apparatus of Swanson '147 and Williams '521 to include that the low temporal coherence light source is a flood illumination source since Davenport '242 teaches of illuminating a sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

Regarding **claim 38**, Swanson '147, Williams '521, and Davenport '242 disclose and teach of an apparatus as shown above, and Davenport '242 further teaches that the light source is a light emitting diode (abstract; col. 5, lines 26-37).

Regarding **claim 45**, Swanson '147 and Williams '521 disclose and teach of a method as shown above, but do not specifically disclose or teach that the two-dimensional OCT operation comprises flood illumination of the sample. In the same field of endeavor of optical imaging, Davenport '242 teaches of flood illumination of a sample for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 and Williams '521 to include that the two-dimensional OCT operation comprises flood illumination of the sample since Davenport '242 teaches of flood illumination of a sample for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

Regarding **claim 46**, Swanson '147 and Williams '521 disclose and teach of a method as shown above, and Swanson '147 further discloses, before step (f): (g) illuminating the sample with low coherent illumination light (col. 5, lines 57-63); (h) detecting the low coherent illumination light reflected from the sample (col. 6, lines 2-58; col. 7, lines 29-40; col. 10, line 35-col. 11, line 22); and (i) adjusting a focus of the optical imaging system in accordance with the low coherent illumination light detected in step (h) (col. 6, lines 2-58; col. 7, lines 29-40; col. 10, line 35-col. 11, line 22, wherein the scatterer 32 is moved in accordance with the light detected to image other sections of the sample), but does not specifically disclose that the sample is illuminated by a flood illumination light source. In the same field of endeavor of optical imaging, Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine

pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 and Williams '521 to include that the sample is illuminated by a flood illumination light source since Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

Regarding **claim 47**, Swanson '147, Williams '521, and Davenport '242 disclose and teach of a method as shown above, and Swanson '147 further discloses that a single detector (54) in the optical imaging system is used to perform steps (f) and (h).

11. **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521), as applied to independent **claim 1** above, and further in view of Kobayashi '144 (US 4,900,144).

Regarding **claim 21**, Swanson '147 and Williams '521 disclose and teach of a method of optical imaging as shown above, but do not specifically disclose or teach that the two-dimensional image of the sample is used to provide diagnostic information about a retinal pathology selected from the group consisting of macular degeneration, retinitis pigmentosa, glaucoma, and diabetic retinopathy. In the same field of endeavor of optical imaging, Kobayashi '144 teaches of using an image of an eye to provide diagnostic information about glaucoma for the purpose of preventing the loss of vision (col. 1, lines 22-35). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Swanson '147 and Williams '521 to include that the two-dimensional image of the sample is

used to provide diagnostic information about a retinal pathology selected from the group consisting of macular degeneration, retinitis pigmentosa, glaucoma, and diabetic retinopathy, since Kobayashi '144 teaches of using an image of an eye to provide diagnostic information about glaucoma for the purpose of preventing the loss of vision.

12. **Claims 31-33** are rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521), as applied to independent **claim 22** above, and further in view of Kerr '016 (US 2004/0156016).

Regarding **claim 31**, Swanson '147 and Williams '521 disclose and teach of an apparatus as shown above, but do not specifically disclose or teach that the low temporal coherence light source is selected from the group consisting of white light sources, semiconductor sources, or solid state lasers. In the same field of endeavor of optical imaging apparatuses, Kerr '016 teaches of a light source selected from the group consisting of semiconductor sources (sec. 0016, 0020, super luminescent diodes) for the purpose of producing both a conventional image and a functional image (sec. 0016). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the apparatus of Swanson '147 and Williams '521 to include that the low temporal coherence light source is selected from the group consisting of white light sources, semiconductor sources, or solid state lasers, since Kerr '016 teaches of a light source selected from the group consisting of semiconductor sources for the purpose of producing both a conventional image and a functional image.

Regarding **claim 32**, Swanson '147, Williams '521, and Kerr '016 disclose and teach of an apparatus as shown above, and Kerr '016 further teaches that the light source is a super luminescent diode (sec. 0016).

Regarding **claim 33**, Swanson '147 and Williams '521 disclose and teach of an apparatus as shown above, but do not specifically disclose or teach that the low temporal coherence light source has a wavelength of about 0.4 microns to about 1.6 microns. In the same field of endeavor of optical imaging apparatuses, Kerr '016 teaches of a light source with a wavelength of about 0.4 microns to about 1.6 microns (sec. 0016) for the purpose of producing both a conventional image and a functional image (sec. 0016). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the apparatus of Swanson '147 and Williams '521 to include that the low temporal coherence light source has a wavelength of about 0.4 microns to about 1.6 microns, since Kerr '016 teaches of a light source with a wavelength of about 0.4 microns to about 1.6 microns for the purpose of producing both a conventional image and a functional image.

13. **Claim 35** is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanson '147 (US 5,465,147) in view of Williams '521 (US 5,949,521), as applied to independent **claim 22** above, and further in view of Smyth '461 (US 6,120,461).

Regarding **claim 35**, Swanson '147 and Williams '521 disclose and teach of an apparatus as shown above, but do not specifically disclose or teach that the 2D-OCT detector is an active pixel array. In the same field of endeavor of optical imaging, Smyth '461 teaches of an optical imaging apparatus wherein the detector is an active pixel array, for the purpose of providing fine

image resolution, and providing the ability to perform at the megahertz raster scan rates of retinal scanning displays (col. 10, lines 9-21). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the apparatus of Swanson '147 and Williams '521 to include that the 2D-OCT detector is an active pixel array, since Smyth '461 teaches of an optical imaging apparatus wherein the detector is an active pixel array, for the purpose of providing fine image resolution, and providing the ability to perform at the megahertz raster scan rates of retinal scanning displays.

14. **Claims 48** is rejected under 35 U.S.C. 103(a) as being unpatentable over Williams '521 (US 5,949,521) in view of Swanson '147 (US 5,465,147), and further in view of Davenport '242 (US 6,663,242).

Regarding **claim 48**, Williams '521 discloses a method for optically imaging a sample of retinal or fundus tissue in the eye (abstract), the method comprising: (a) providing an optical imaging system comprising an adaptive optical element (Fig. 1; col. 4, lines 13-37, deformable mirror 118); (b) measuring wavefront aberrations in the eye (col. 4, line 13-col. 5, line 40); (c) controlling the adaptive optical element (118) to correct the wavefront aberrations measured in step (b) (col. 4, line 13-col. 5, line 40), but does not specifically disclose (d) illuminating the sample with low coherent illumination light; (e) detecting the low coherent illumination light reflected from the sample; (f) adjusting a focus of the optical imaging system in accordance with the low coherent illumination light detected in step (e); and (g) performing an OCT operation on the sample to image the sample; wherein a single detector in the optical imaging system is used to perform steps (e) and (g). In the same field of endeavor of optical imaging, Swanson '147

teaches of (d) illuminating the sample with low coherent illumination light (col. 5, line 57-col. 6, line 58); (e) detecting the low coherent illumination light reflected from the sample (col. 6, lines 2-58; col. 7, lines 29-40; col. 10, line 35-22); (f) adjusting a focus of the optical imaging system in accordance with the low coherent illumination light detected in step (e) (col. 6, lines 2-58; col. 7, lines 29-40; col. 10, line 35-22, wherein the scatterer 32 is moved in accordance with the detected light to image other sections of the sample); and (g) performing an OCT operation on the sample to image the sample (col. 5, line 57-col. 6, line 58; col. 6, lines 2-58; col. 7, lines 29-40; col. 10, line 35-22); wherein a single detector (54) in the optical imaging system is used to perform steps (e) and (g) (col. 6, lines 2-58), for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object (col. 3, lines 35-41). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Williams '521 to include the steps of (d) illuminating the sample with low coherent illumination light; (e) detecting the low coherent illumination light reflected from the sample; (f) adjusting a focus of the optical imaging system in accordance with the low coherent illumination light detected in step (e); and (g) performing an OCT operation on the sample to image the sample; wherein a single detector in the optical imaging system is used to perform steps (e) and (g), since Swanson '147 teaches of (d) illuminating the sample with low coherent illumination light; (e) detecting the low coherent illumination light reflected from the sample; (f) adjusting a focus of the optical imaging system in accordance with the low coherent illumination light detected in step (e); and (g) performing an OCT operation on the sample to image the sample; wherein a single detector in the optical imaging system is used to perform

steps (e) and (g), for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object.

Williams '521 and Swanson '147 disclose and teach of a method as shown above, but do not specifically disclose or teach of illuminating the sample with low coherent flood illumination light. In the same field of endeavor of optical imaging, Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image (col. 10, lines 35-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Williams '521 and Swanson '147 to include that the sample is illuminated by a flood illumination light source since Davenport '242 teaches of illuminating the sample with a flood illumination light source for the purpose of detecting non-refractive errors, such as cataracts, and to determine pupil size and baseline retinal reflectivity, via an optical image.

15. **Claim 55** is rejected under 35 U.S.C. 103(a) as being unpatentable over Williams '521 (US 5,949,521) in view of Swanson '147 (US 5,465,147), and further in view of Smyth '461 (US 6,120,461).

Regarding **claim 55**, Williams '521 discloses a method for optically imaging a sample of retinal or fundus tissue in an eye (abstract), the method comprising: (a) providing an optical imaging system comprising an adaptive optical element (Fig. 1; col. 4, lines 13-37, deformable mirror 118); (b) measuring wavefront aberrations in the eye (col. 4, line 13-col. 5, line 40); (c) controlling the adaptive optical element (118) to correct the wavefront aberrations measured in

step (b) (col. 4, line 13-col. 5, line 40), but does not specifically disclose (d) performing an OCT operation on the sample to image the sample. In the same field of endeavor of optical imaging, Swanson '147 teaches of performing an OCT operation on the sample to image the sample (col. 5, line 57-col. 6, line 58; Fig. 2) for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object (col. 3, lines 35-41). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Williams '521 to include the step of (d) performing an OCT operation on the sample to image the sample since Swanson '147 teaches of performing an OCT operation on the sample to image the sample for the purpose of acquiring images of an object at a high rate in a parallel manner without any transverse scanning across an object.

Williams '521 and Swanson '147 disclose and teach of a method for optical imaging as shown above, but do not specifically disclose or teach that step (d) is performed using an active pixel array. In the same field of endeavor of optical imaging, Smyth '461 teaches of a method for optical imaging wherein the detector is an active pixel array, for the purpose of providing fine image resolution, and providing the ability to perform at the megahertz raster scan rates of retinal scanning displays (col. 10, lines 9-21). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Williams '521 and Swanson '147 to include that step (d) is performed using an active pixel array since Smyth '461 teaches of a method for optical imaging wherein the detector is an active pixel array, for the purpose of providing fine image resolution, and providing the ability to perform at the megahertz raster scan rates of retinal scanning displays.

Allowable Subject Matter

16. **Claims 11 and 12** are objected to as shown above, but would be allowable if rewritten to overcome the above objection and if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 11-15, 36, 39, 44, 49-51, and 56 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 40-41 are objected to as shown above, but would be allowable if rewritten to overcome the above objection

Claims 52-54 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: none of the prior art either alone or in combination discloses or teaches of the claimed combination of limitations to warrant a rejection under 35 U.S.C. 102 or 103.

Regarding **claim 11**, none of the prior art either alone or in combination discloses or teaches of a method of optical imaging as claimed, specifically wherein steps (i)-(iii) are carried out concurrently with steps (iv)-(ix).

Regarding **claims 12-15**, none of the prior art either alone or in combination discloses or teaches of a method of optical imaging as claimed, specifically wherein the method further comprises tracking and compensating for axial motion of the sample by: generating a beam of low temporal coherence 1D-OCT light from a light source, splitting the beam of low temporal coherence 1D-OCT light to create a 1D-OCT sample light beam and a 1D-OCT reference light beam, each having an optical path length corresponding to a coherence gate position at a desired

region of the sample to be imaged, illuminating the sample with the 1D-OCT sample light beam, illuminating the reference mirror with the 1D-OCT reference light beam, superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position, recording a series of interference patterns corresponding to a series of coherence gate positions using a 1D-OCT detector, determining a change in axial position of the sample by analyzing the interference patterns recorded by the 1D-OCT detector, and adjusting the optical path length of the reference light beam so as to axially move the coherence gate position of the sample light beam thereby compensating for the measured axial motion of the sample.

Regarding **claim 36**, none of the prior art either alone or in combination discloses or teaches of an optical imaging apparatus as claimed, specifically wherein the apparatus further comprises a 1D-OCT axial scanning subsystem comprising a low temporal coherence 1D-OCT light source and a 1D-OCT detector.

Regarding **claim 39**, none of the prior art either alone or in combination discloses or teaches of an optical imaging apparatus as claimed, specifically wherein the low coherence flood illumination light source is coupled to a multi-mode fiber.

Regarding **claim 40**, none of the prior art either alone or in combination discloses or teaches of a method of optically imaging a sample as claimed, specifically comprising the steps of (iv) generating a beam of low temporal coherence 1D-OCT light from a light source, (v) splitting the beam of low temporal coherence 1D-OCT light to create a 1D-OCT sample light beam and a 1D-OCT reference light beam, each having an optical path length corresponding to a coherence gate position at a desired region of the sample to be imaged, (vi) illuminating the

sample with the 1D-OCT sample light beam, (vii) illuminating the reference mirror with the 1D-OCT reference light beam, (viii) superimposing the reflected sample light beam and reflected reference light beam to obtain an interference pattern corresponding to the coherence gate position, (ix) recording a series of interference patters corresponding to a series of coherence gate positions using a 1D-OCT detector, (x) determining a change in axial position of the sample by analyzing the interference patterns recorded by the 1D-OCT detector.

Regarding **claim 41**, none of the prior art either alone or in combination discloses or teaches of an optical imaging apparatus as claimed, specifically wherein the apparatus further comprises (i) a 1D-OCT low temporal coherence super luminescent diode light source, (j) a 1D-OCT detector, and (k) a low coherent flood illumination light source coupled to a multi-mode fiber.

Regarding **claim 44**, none of the prior art either alone or in combination discloses or teaches of an optical imaging method as claimed, specifically wherein the first OCT operation if a 1D-OCT operation.

Regarding **claims 49-51**, none of the prior art either alone or in combination discloses or teaches of an optical imaging method as claimed, specifically wherein step (d) is performed with a light source coupled to a multi-mode optical fiber.

Regarding **claims 52-54**, none of the prior art either alone or in combination discloses or teaches of an optical imaging method as claimed, specifically comprising the step of (d) illuminating the sample with low coherent flood illumination light by using a light source coupled to a multimode optical fiber.

Regarding **claim 56**, none of the prior art either alone or in combination discloses or teaches of an optical imaging method as claimed, specifically wherein step (d) comprises beat frequency detection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael P. Roberts whose telephone number is (571) 270-1288. The examiner can normally be reached on Monday-Friday 8am-4/5pm with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Mack can be reached on (571) 272-2333. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael Roberts

MPR

Ricky Mack
RICKY MACK
SUPERVISORY PATENT EXAMINER